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A Childcare Registration System with Activity Log and Multilevel Authentication for Pusat Jagaan Tunas Husnina

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Abstract: A childcare registration system is a system that registers and manages the child's personal information at Pusat Jagaan Tunas Husnina such as home address and their parent's contact number. The reason this system is developed is that the existing registration process at Pusat Jagaan Tunas Husnina is using a manual method which is to fill in the form paper. This manual process will be prone to many human errors, is less secure and is time-consuming for the teacher, admin or other related people to access back the data. The PHP language and waterfall methodology are used as a methodology to develop this system. At the end of this project, a childcare registration system for Pusat Jagaan Tunas Husnina is able to register and manage the child's data at their childcare with an applied multilevel authentication system.

Keywords: Activity Log, Multilevel Authentication, One-Time Password (OTP)

1. Introduction

Childcare is the provision of care and supervision for children, typically in their parents' or guardians' absence. It is the process of assuring the health, safety, and development of children. Working parents and those who need assistance caring for their children for a variety of reasons must have access to childcare services. Childcare can occur in a variety of contexts, such as nursery centres, nurseries, preschools, or at home with caretakers or babysitters. The primary objective of childcare is to provide a compassionate and supportive environment in which children can flourish physically, emotionally, socially, and intellectually.

A childcare registration system is a system that registers and manages the children's personal information at Pusat Jagaan Tunas Husnina. This system will be used by the admin and the teacher to keep the children's personal information online. The importance of this information being kept online is to make it easier to access the data anytime and anywhere.

The existing children's registration process at Pusat Jagaan Tunas Husnina is by using paper and it needs to be kept in a separate file for each child. All the children's data files will be kept on a rack in

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the childcare office. The admin and the teachers of Pusat Jagaan Tunas Husnina can access the document.

Because the children's personal information is being kept on paper, it is quite hard for the admin or teachers to access the children's information whenever they need it immediately. For example, when they need the children's information to be sent to the Social Welfare Department (JKM) since Pusat Jagaan Tunas Husnina is a registered childcare centre under JKM. In addition, the possibility of the paper containing the child's personal information being lost is also high because it is only kept in a file without additional security measures, and it also has the possibility of mistakenly placing the paper in another child's file [1].

To overcome this problem, a childcare registration system with an activity log and multilevel authentication such as username password and One-Time Password (OTP) for Pusat Jagaan Tunas Husnina is developed. This system will store and manage the children's personal information with activity logs and multilevel authentication. Only authorized users can access the system, and this system also redirects authorized users to their respective pages according to their role of authorization.

Without the registration system, Pusat Jagaan Tunas Husnina has typically used a manual registration process which is manually filling in the form using paper. One of the issues that arise when using this existing method is the admin finds it difficult to find the children's records whenever they need them. It makes the access process of the children's information need more time and it is inconvenient especially when there is an emergency that requires, for example, the parent of the children's phone number [2]. Not only that but it can also be destroyed or misplaced in other children's files. This would mess everything up and all the child records would have to be rearranged, causing more work [2].

Therefore, the development of a childcare registration system that implements the activity log and multilevel authentication may reduce the risk of unauthorized access to the children's information and manage the children's records more efficiently for a faster-accessing process. The objective of this project is:

- To design a registration system for children registration with activity logs and multilevel authentication for Pusat Jagaan Tunas Husnina.
- To develop a registration system for children registration with activity logs and multilevel authentication for Pusat Jagaan Tunas Husnina.
- To test the functionality of a registration system for children registration with activity log and multilevel authentication for Pusat Jagaan Tunas Husnina.

The childcare registration system allows the admin and the teachers to register and manage the children's information. This system is implemented with multilevel authentication to ensure only an authorized person can access the children's record and an activity log in which the admin can monitor which admin or teacher makes changes to the children's information. It will also help the administrators track who may have edited or entered incorrect child information into the system, or if there is any misleading information in a child's record.

In Section 2, authentication, and security in data logging are described. The relationship and similarities between data logging and the activity log are also described in Section 2, as well as a comparison between the existing system and the Tunas Husnina Registration System. The Waterfall methodology is described in Section 3 as the methodology used for this development. The user interface and part of the Tunas Husnina Registration System's testing are illustrated in Section 4, which discusses the implementation and testing of the system. Lastly, the conclusion will be discussed in Section 5.

2. Literature Review

2.1 Security in Data Logging

According to [3], one of the top ten security threats that were highlighted in 2017 by the Open Web Application Security Project (OWASP) was inadequate logging and monitoring. Attackers are able to wreak damage to an organisation while remaining undiscovered for extended periods of time if the software systems exploited have poor logging capabilities.

For example, in November of 2018, Marriott International publicly announced that it had been the victim of a massive data breach–the second largest in the history of the world. This breach affected approximately 327 million of the company's customers, and the confidential information of those customers was made public. An examination that was carried out indicated that malicious actors had access to personal information belonging to consumers as far back as 2014 [4]. This indicates that the criminals went unnoticed for around four years. Logging might have been implemented in Marriott's reservation systems, which would have helped the company uncover security breaches more quickly[3].

2.2 Data Logging and Activity Log

According to [5], an audit log is often one of the strategies that are used in tracking changes throughout the course of recording history and maintaining a record of any action. It generates a record that includes a shift in the timeframe. By reviewing the data that the computer has logged, it is possible to determine what kinds of actions occurred at a certain time and date. Logged data records the activities of the computer. Audit logs or audit trails would ordinarily preserve a record of the events or actions that were specifically assigned to be tracked, as well as the chronology in which they occurred [5]. The activity log, on the other hand, is a record that is kept of how time is spent[6]. In most cases, the activity log is used to maintain a record of the length of time that users spend logged into a certain system or application. For instance, an activity log will maintain a record of how the workers of a company spend their time while working there [7].

2.3 Authentication

Authentication refers to the mechanisms that allow systems to identify whether a user is who they claim to be. Two-factor authentication is essentially a validation method that uses two types of authentications to produce a system with up-to-date security features. The verifying account's website is related to two-factor authentication processes such as creating a six-digit random number of One-Time Password (OTP), employing picture verification, and using the verification account website [8]. This will make the personal information of the user account hard to obtain by hackers or third parties.

A One-Time Password (OTP) is a string of symbols produced for a single usage. It makes no sense to listen in. Because of its invalidity, used OTP is almost worthless to an attacker. The first implementations of OTP-based authentication protocols assumed storing OTPs as a static set of secret passes on a data carrier. OTPs are now dynamically created on demand using cryptographic algorithms [9].

In comparison to traditional passwords, OTPs avoid a lot of concerns. One-Time Passwords solve a major flaw: they are not vulnerable to replay attacks, phishing attacks, or any other sort of attack. OTPs that have already been used to access a service such as a web-based system will no longer be valid, making an intruder unable to exploit them. Humans, on the other hand, have a terrible time remembering OTPs. As a result, they require additional equipment to operate [10].

2.4 Comparison of The System

Comparing existing systems and a childcare registration system with activity log and multilevel authentication for Pusat Jagaan Tunas Husnina, there are similarities and differences. WSRS, RIS, and

a childcare registration system with activity log and multilevel authentication have a login page for all the users. As for the advanced security features, there is no OTP email authentication and data logging function in all existing systems. All the existing system and the Tunas Husnina Registration System has an admin module that can access the user or student list, register, update and delete the user or student but only the SPP Damya Deena does not allow the admin to update or delete the student. The Web-Based student registration system (WSRS) does not allow the user to register the student while the rest of the existing system and the Tunas Husnina Registration System allow it. All existing systems do not allow the user to update the student while this system allows it. Only the SPP Damya Deena and the Tunas Husnina Registration System is allowing the user to access the student list while the rest of the existing system does not allow it. All the existing systems and Tunas Husnina Registration System are web-based systems, and the manual existing system of Pusat Jagaan Tunas Husnina does not have all the functions. Table 1 showed the comparison between the Web-based Student Registration System (WSRS) and Registration Information System (RIS) and Tunas Husnina Registration System.

Table 1: Comparison between the existing system and the Tunas Husnina Registration System

Function	Web-Based Student Registration System (WSRS)[11]	Registration Information System (RIS)[12]	SPP Damya Deena[13]	The manual existing system of Pusat Jagaan Tunas Husnina	Tunas Husnina Registration System
Login page to all users	Yes	Yes	Yes	No	Yes
OTP email authentication	No	No	No	No	Yes
Data logging function	No	No	No	No	Yes
Admin register user	Yes	Yes	Yes	No	Yes
Admin update user	Yes	Yes	Yes	No	Yes
Admin delete user	Yes	Yes	Yes	No	Yes
Admin access user list	Yes	Yes	Yes	No	Yes
Admin access student list	Yes	Yes	Yes	No	Yes
Admin register student	Yes	Yes	Yes	No	Yes
Admin update student	Yes	Yes	No	No	Yes
Admin delete student	Yes	Yes	No	No	Yes
User register student	No	Yes	Yes	No	Yes
User update student	No	No	No	No	Yes
User access student list	No	No	Yes	No	Yes
Web-based system	Yes	Yes	Yes	No	Yes

3. Methodology

Waterfall methodology was chosen to develop the Tunas Husnina Registration System. The reason this methodology was chosen is that the waterfall technique is straightforward, easy to grasp, and

provides a straightforward methodology for managing production concerns. Additionally, it is simpler to keep Software Development on budget while utilising this method [14]. Figure 1 shows that there are six phases in the Waterfall methodology which are a requirement, design, implementation, testing, deployment and maintenance. Refer to Appendix A for the project timeline Gantt Chart.

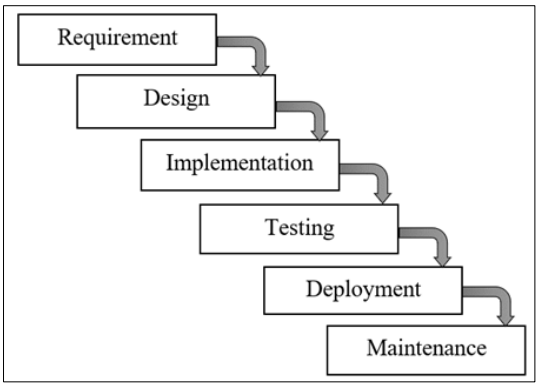


Figure 1: Phases in Waterfall methodology [11]

3.1 Requirement Gathering and Analysis

During the requirement phase, an analysis of the existing registration systems takes place. A review of the system's implementation of activity logs and multi-level authentication is being conducted, and requirements are being gathered. The gathering and analysis of all of the journal papers and publications relating to the activity log, OTP, and registration system have begun. A search is performed for the paper in several database engines, including Google Scholar, IEEE Xplore, and ScienceDirect. The relevant keyword may be broken down into three subparts. The first section discusses activity logs, the second section discusses multilevel authentication, and the third and final section discusses OTP.

3.2 System Analysis and Design

For the creation of the Tunas Husnina Registration System, the Data Flow Diagram (DFD), Entity Relationship Diagram (ERD) and activity diagram are created during the analysis and design phase.

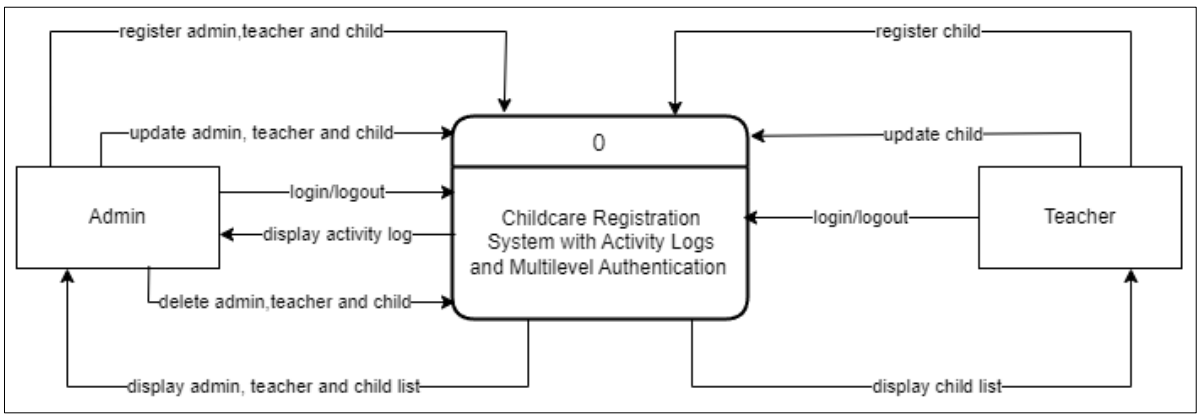


Figure 2: Data flow diagram context diagram (DFD CD)

Figure 2 shows the data flow diagram context diagram for the Tunas Husnina Registration System that have two entity which is the admin and the teacher.

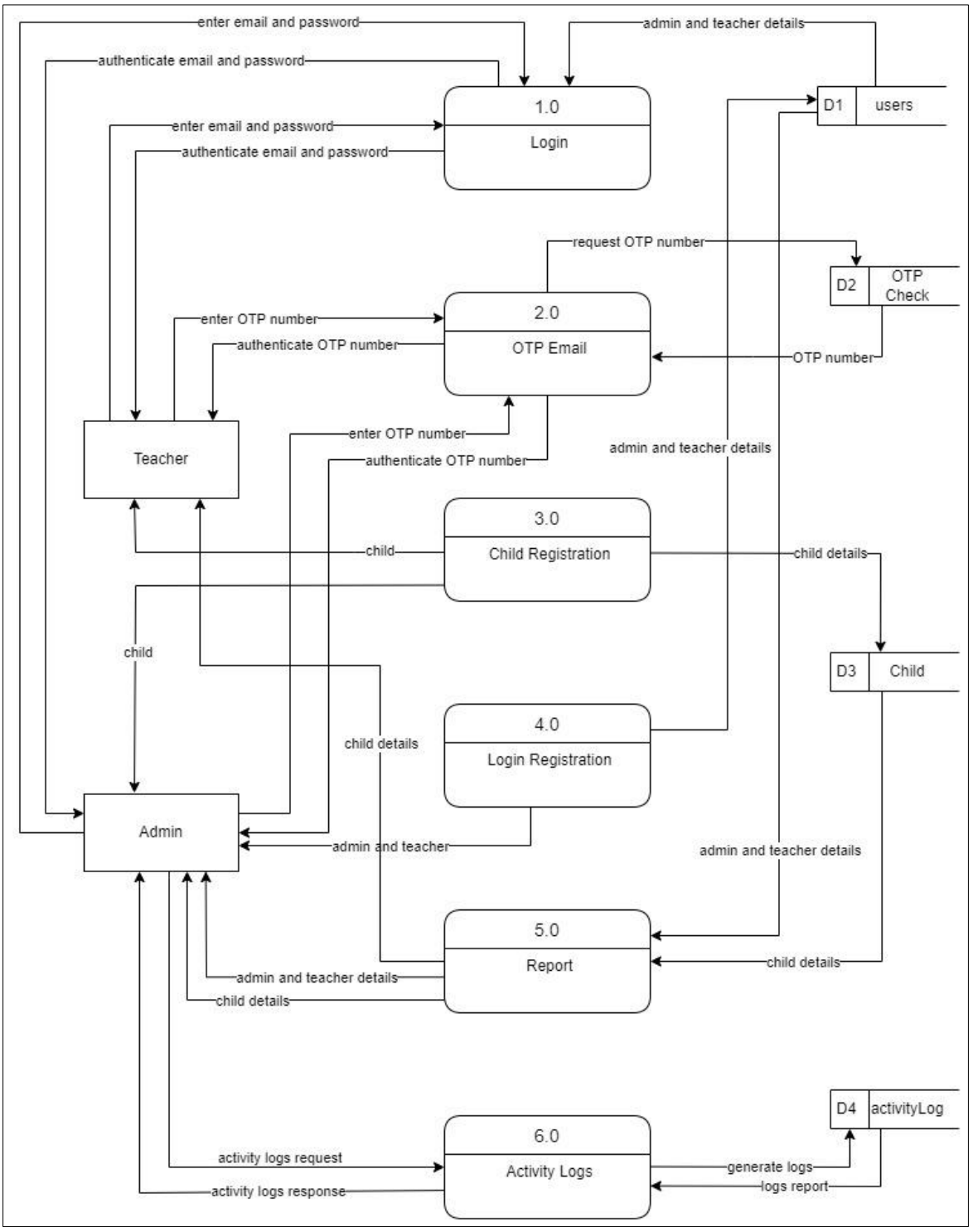


Figure 3: Data flow diagram (Level 0) of Tunas Husnina Registration System

Figure 3 included a data flow diagram that illustrated the Tunas Husnina Registration System's procedures, as well as the flow of information, the entities that would be participating in the system, and the data storage for the information. Within the system, there are two different users or entities. They fill the roles of admin and teacher. The procedures and information flow that each entity uses might be the same or different.

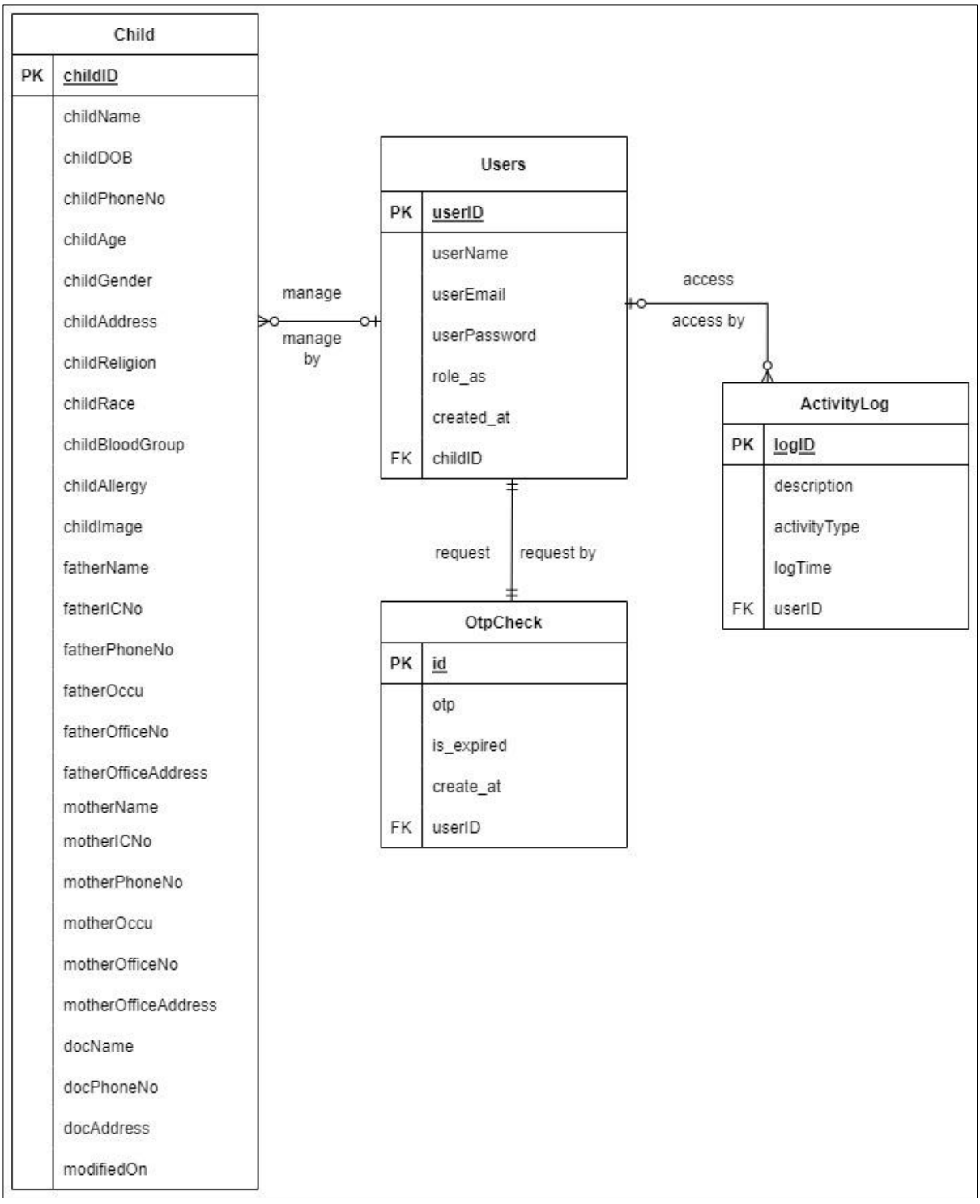


Figure 4: Entity relationship diagram for the Tunas Husnina Registration System

The entity relationships diagram is shown in Figure 4. The graphic contained four tables that were connected. The Users table is used to hold information about the admin and teacher. Three distinct tables are constructed. They are Child links to table users. In addition, the table activityLog and OtpCheck are linked to the table users.

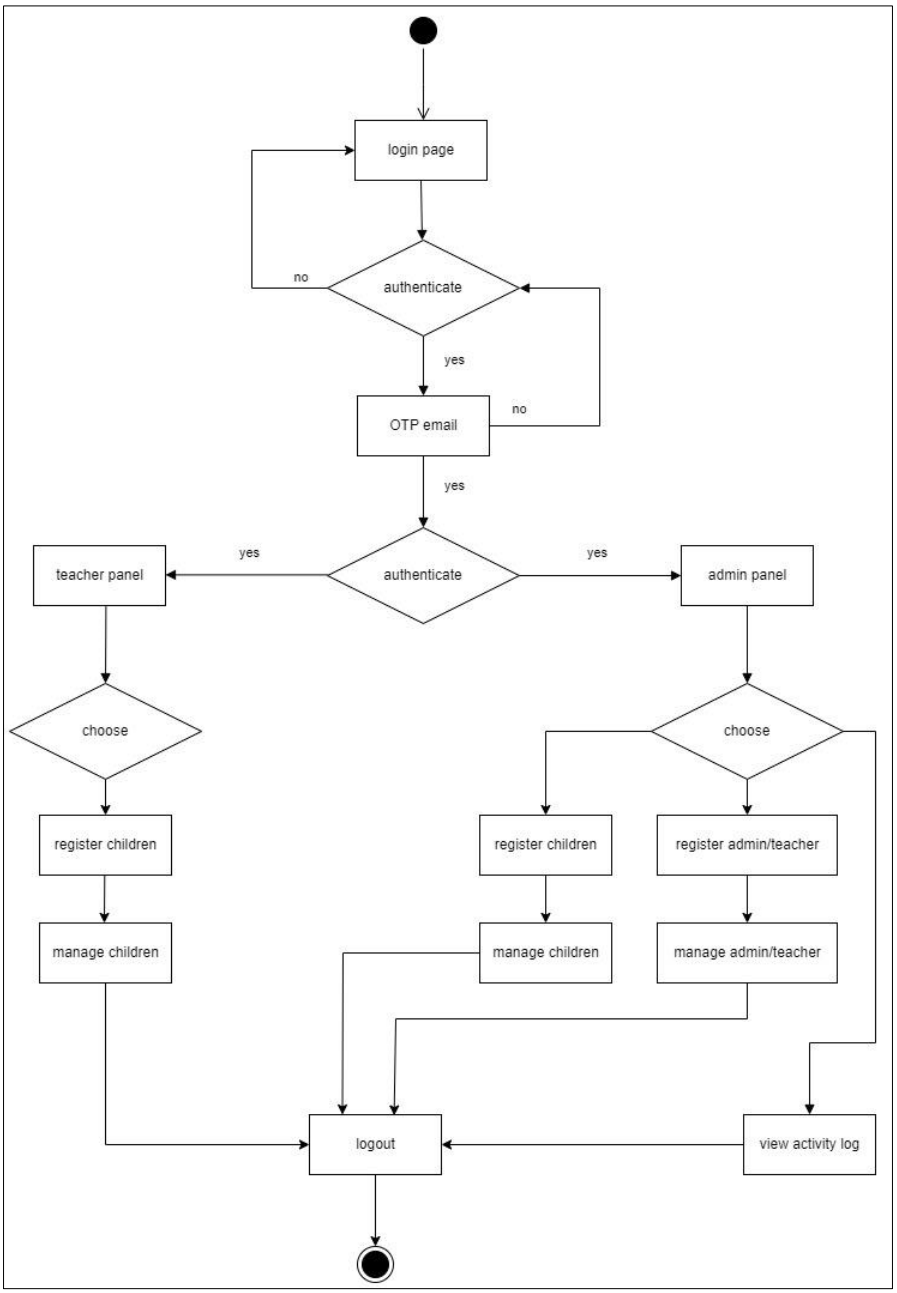


Figure 5: Activity diagram for Tunas Husnina Registration System

Figure 5 shows the activity diagram of the Tunas Husnina registration system that starts with the login page. First, the user must enter information on the login page, followed by the authentication check. If the detail is valid, the system will send the OTP email to the user's email. If the details are not valid, the system will redirect them to the login page. Then, if the OTP is valid, the system will authenticate the user for access to the specific page, which is either the teacher or administrator page but if the OTP is not valid, the system will ask to enter the OTP number.

On the teacher page, the teacher can add the children and manage it. While on the admin page, the admin can choose to register and manage the children, admin and teacher or view the activity log.

The functional requirement of a system is implemented so that users can utilise the system's functions. There are eight modules in the registration system of Tunas Husnina. Each module has a unique set of authorised individuals who can access its functions. For example, only the admin can access the module activity log. Table 2 shows the Tunas Husnina Registration System's modules.

Table 2: Module of Tunas Husnina Registration System

Module	Description
Login	Allow authorized admin/teacher to log into the system
Create user	Admin: can add new admin and teacher
Registration	Admin: can add, edit and delete the children's information in the system. Teacher: can only add and edit the children's information in the system.
Children list	Allow admin/teacher to see the children's list
Teacher list	Allow admin to see the teacher's list
Admin list	Allow the admin to see the admin's list
Activity log	Allow the admin to see the activity log of the teacher
Logout	Allow admin/teacher to logout from the system

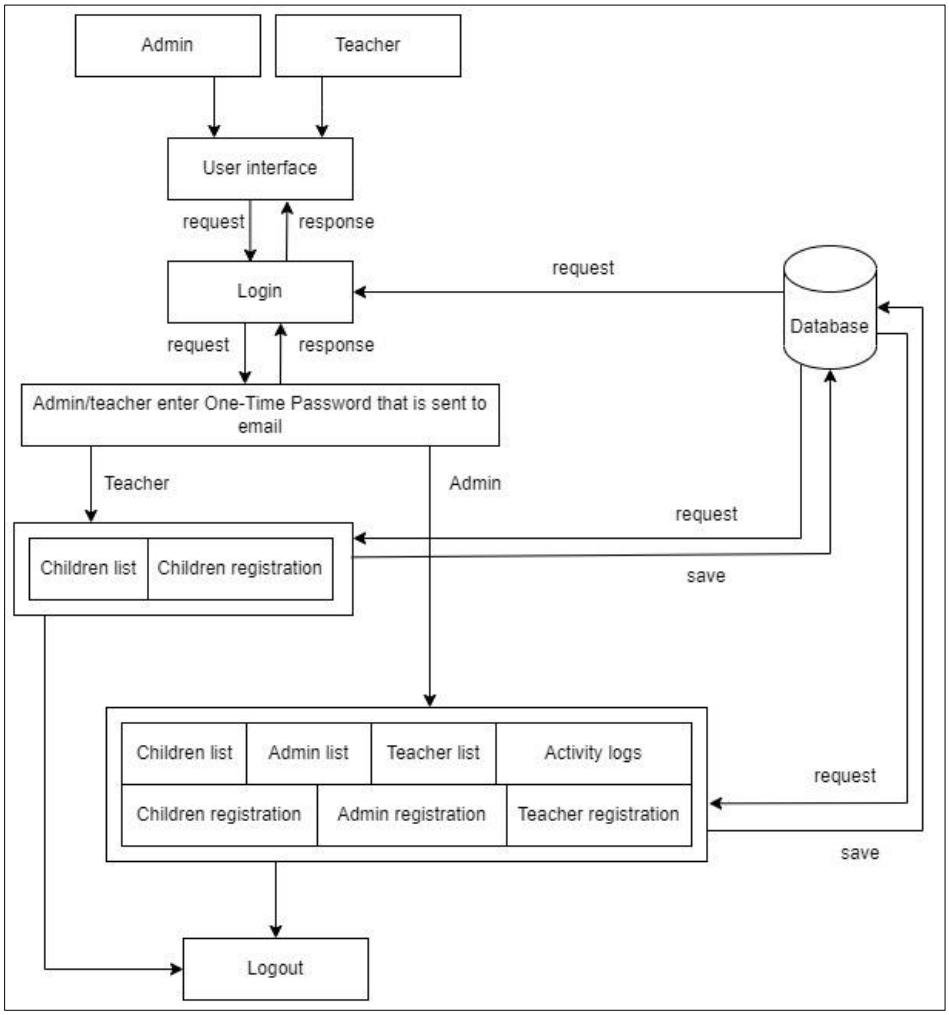


Figure 6: System architecture design of Tunas Husnina Registration System

Figure 6 shows the system architecture design of the Tunas Husnina registration system. It illustrates the Tunas Husnina registration system's modules. The database will contain the data and information collected from users. The modules will request the database and provide a response.

4. Result and Discussion

The purpose of this section is to describe the main security features of the Tunas Husnina registration system. All source codes are developed to ensure that the system's functionality follows the specifications. The Tunas Husnina Registration System's security features will include confidentiality, integrity, and availability.

4.1 Security Implementation

Figure 7 shows the login page that can be accessed by all users. Users are required to enter their registered email address in addition to their password. Following this, the system will check whether or not the input is correct. If all the user inputs are correct, the system will request information about the OTP number that was sent to the user.

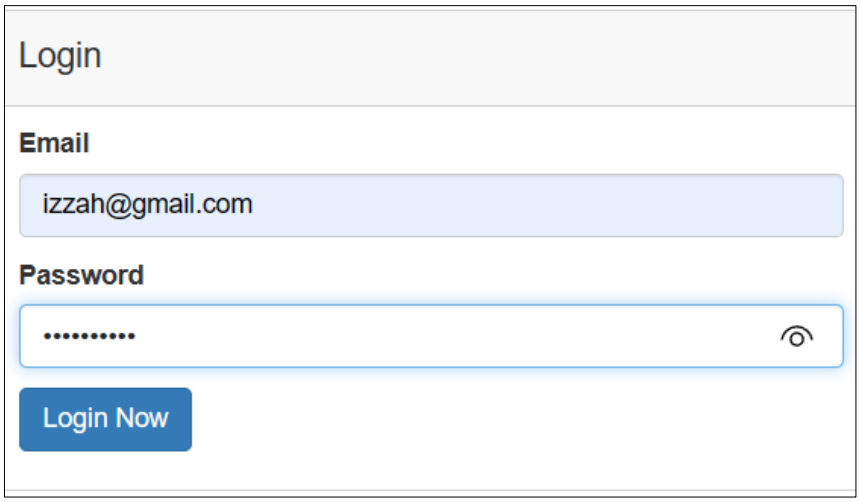


Figure 7: Login page for all user

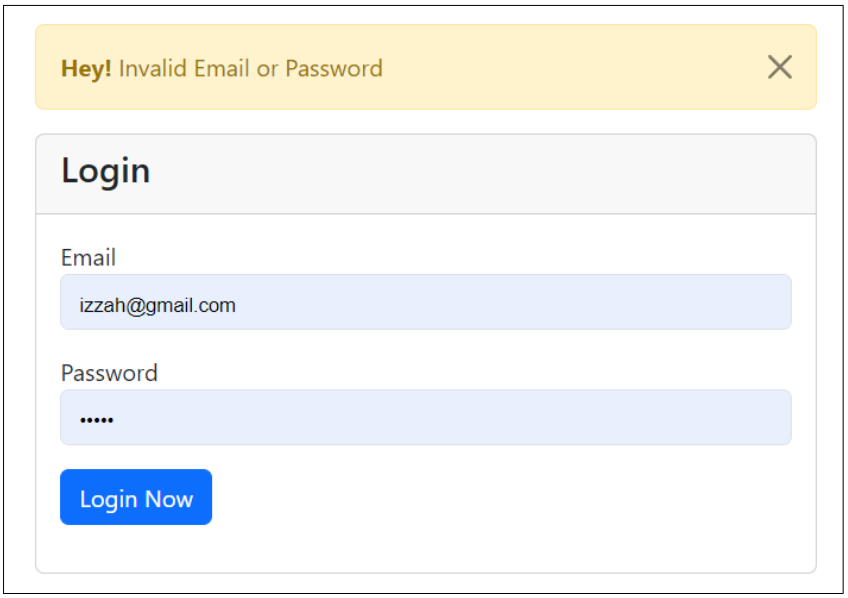


Figure 8: Error message for invalid email or password

Figure 8 shows the error message when the admin or the teacher enters an invalid email or password. The activity occurred as a direct consequence of entering an incorrect login or password. The website will display a pop-up with the notification "Hey! Invalid Email or Password" when the incorrect username or password is entered, as illustrated in Figure 8. Since the Tunas Husnina Registration System does not indicate which input areas are incorrect, there will be a smaller chance for someone to successfully guess the login and password.

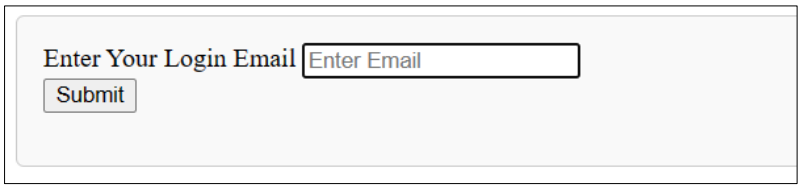


Figure 9: Interface for the user to enter email address

Figure 10: Interface for the user to enter OTP number

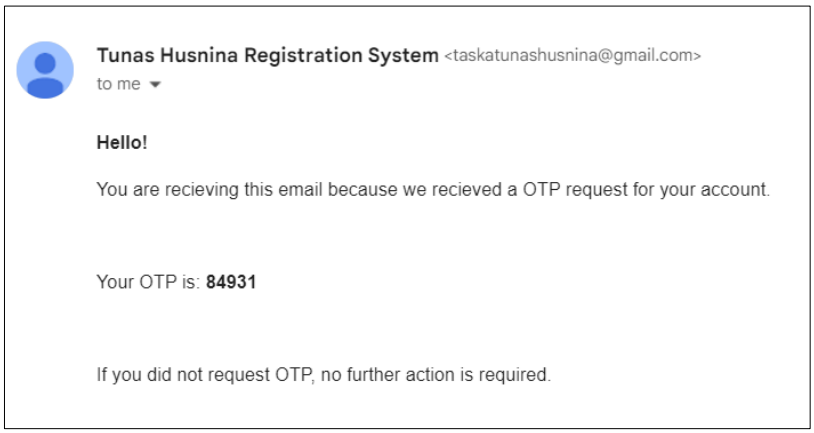


Figure 11: OTP email that the user receives

In order for the system to determine whether or not the user's supplied email address is identical to the one stored in the database, the user will be requested to input their email address. If both of the user's email addresses are the same, an OTP consisting of five digits will be emailed to the user. The user interface for the page containing the email address, the user interface for entering the OTP number, and an example email that is delivered to the user are shown in Figures 9, 10, and 11, respectively.

userID ▼ 1	userName	userEmail	userPassword
24	namtarn	namtarn2333@gmail.com	$2y$10$tY5A2oElMNuiklXN1E2qoOsRprLgRgsQxG5l/JMVdJK...
23	Azlina	azlina@gmail.com	$2y$10$/MgXGjW2KJnO/CP7CvZNcu1UTCh36HZydyWldr99Xg6...
22	suhaidi	suhaidi@gmail.com	$2y$10$miaL3VVbv8HYNqh1AfQhweaxkZR7uPinf0j.yCJnU8....
21	fakhira	fakhira@gmail.com	$2y$10$9N7BMVSDqCT6m6BDjjFK0.OhN9ZfX8qEj7L/iTmDNDt...

Figure 12: The hash password in the database

Before storing the entered password in the database, the system will encode it. This indicates that a unique security phrase will be embedded within each password so that no two stored passwords are identical. Figure 12 shows an example of how databases store the password.

4.2 Implementation of Module

Figure 13 shows the registered children list. The children list can be accessed by all users which is the admin and the teacher. The registered children list shows the child's id, child's name, the child's date of birth, child's phone number, child's gender, child's religion, child's race and child's allergy.

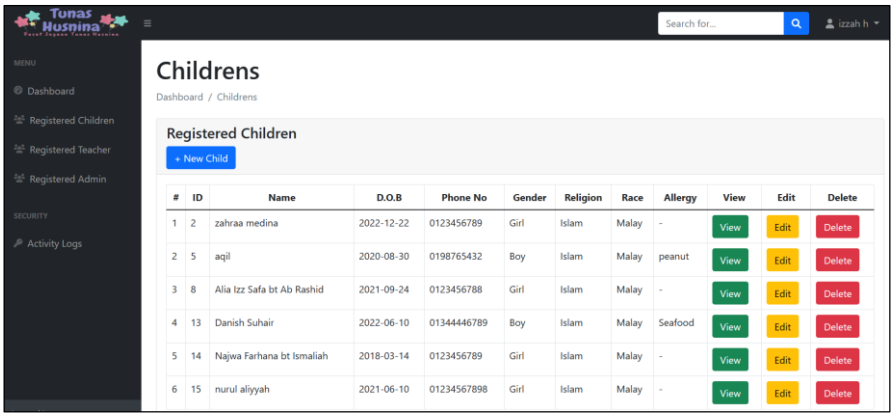


Figure 13: Children list interface

In the children registration module, the admin and the teacher can register a new child by clicking the '+New Child' button. Other than that, they can also manage the registered child by clicking the view, edit or delete button on the specific child as shown in Figure 13. All the activities that the admin or the teacher did such as registering a new child, editing or deleting the registered child will be recorded in the activity log.

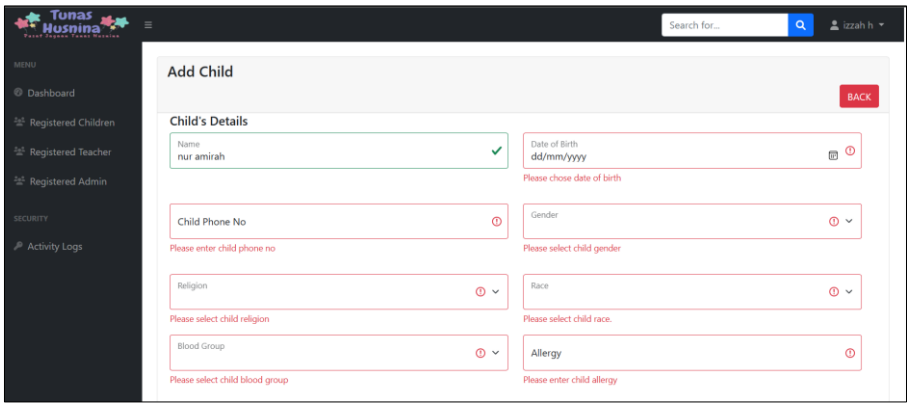


Figure 14: Child registration form with input validation

The interface of the children's registration form with the input validation is shown in Figure 14. The children's registration form required the user to fill in the information about the child, the information about their parents and their personal physician if they have one. The children's registration form also has an input validation that needs to be met when filling in the form. For example, the gender input field is mandatory, if there is no selection for gender made by the admin or the teacher, the system will display an error message.

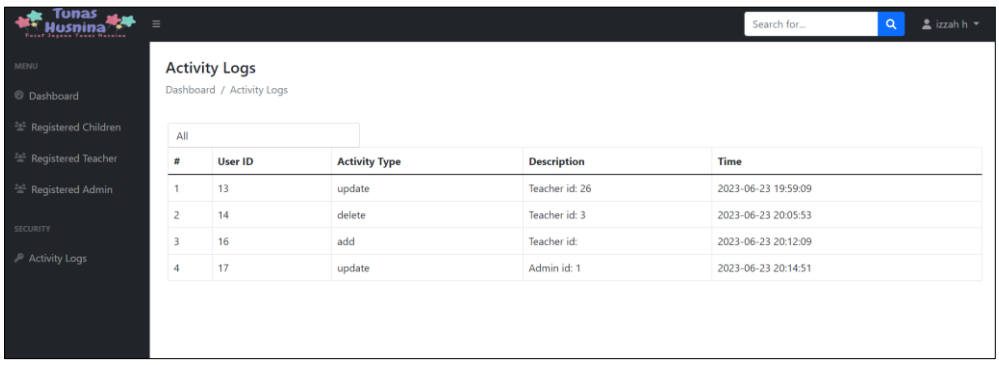


Figure 15: Interface of the activity log history in the admin module

Figure 15 shows the interface of the activity log history in module admin which displays all the activity that the user did while using the Tunas Husnina Registration System. The activity log displays the user id that makes changes to the registered admin, teacher or children. All the activity logs are recorded with the accurate date and time.

4.3 Functionality test results

Testing is performed on this project to ensure that all the functionality, both in terms of the modules and the security, works as intended. Table 3 showed the test plan for ten different Tunas Husnina registration system modules depending on the category given in Table 4. Table 5 showed the security testing that was performed on the Tunas Husnina registration system.

Table 3: Test Plan

Test Category	Description	Expected Results	Actual Result
1	Register Children i. Click on the add children to register a new child. ii. Insert child information. iii. Click add child	i. A new child is added ii. The children's list refreshes after a new child is added.	Pass
	View child information i. Show the child information	i. The child's information is displayed including the parent's and physician's details.	Pass
	Edit child information i. Edit the specific child information.	i. Can update all child's information including their parents and physician details.	Pass
	Delete child information i. Click on the chosen child to delete	i. The chosen child is deleted.	Pass
2	Register admin i. Click on the add new admin button. ii. Insert admin Id, username, admin name, and password. iii. Click the submit button to add admin.	i. A new user admin is added to the system.	Pass
	Edit admin i. Edit the specific child information.	i. Can edit the admin's name and email address.	Pass
	Delete admin i. Click on the chosen admin to delete.	i. The chosen admin is deleted.	Pass
	Register teacher i. Click on add new teacher button. ii. Insert teacher Id, teacher name, username, and password.	i. A new user teacher is added to the system.	Pass
	Edit teacher i. Edit the specific teacher information.	i. Can edit the teacher's name and email address.	Pass
	Delete teacher ii. Click on the chosen teacher to delete.	iii. The chosen teacher is deleted.	Pass

Table 4: Test category

Test Category	Description
1	Test the functionality of the system will store and manipulate the registered children's data. The system must allow add, update, view, and delete.
2	Test the functionality of the system will store and manipulate the user detail data.

Table 5: Security checklist for the Tunas Husnina Registration System

No	Checklist	Actual Result
1	Passwords should not be visible in the textbox during login.	Pass
2	Ensure the error message does not directly indicate which part of the authentication data is incorrect. For example, an error message should not show “incorrect password” or “incorrect username”.	Pass
3	Enforce the complexity of the password	Pass
4	Enforce the password length inside the policy	Pass
5	Password and OTP email are used for high security.	Pass

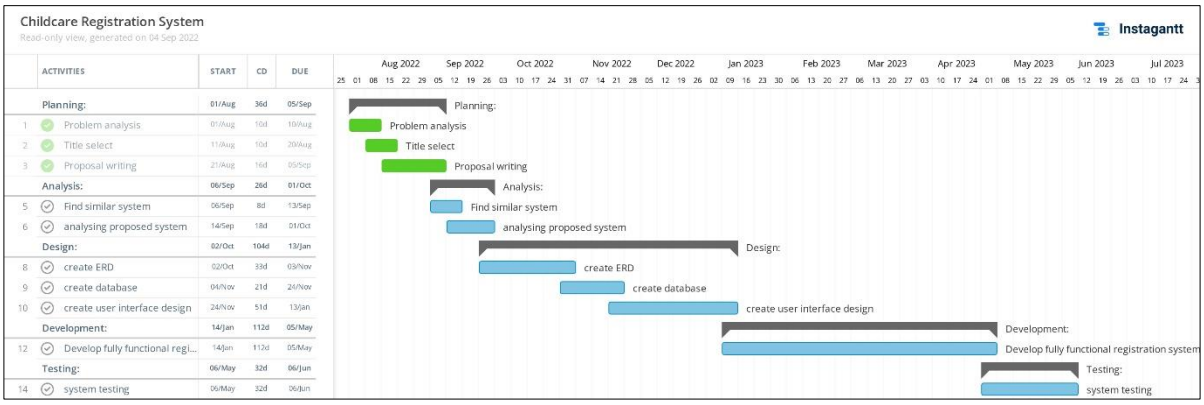
5. Conclusion

One of the initiatives being taken to strengthen the management system at Pusat Jagaan Tunas Husnina to make it more effective in managing the information related to the children in their care is the development of a childcare registration system. It is recommended that more features, such as a payment gateway, be added to this system in the future so that parents can pay for childcare services. In addition, it is recommended to increase the number of security measures to maintain the data's privacy and confidentiality.

Acknowledgement

The authors would like to thank the Faculty of Computer Science and Information Technology, Universiti Tun Hussein Onn Malaysia for its support and encouragement throughout the entirety of the process of carrying out this study.

Appendix A



Gantt Chart

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